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ABSTRACT

In an attempt to serve underprepared students--students who are beginners in writing, reading, and logical thinking skills--the English department at Keene State College in New Hampshire has been evolving a developmental English composition course designed to enable these students to participate effectively in their subsequent general education courses. Research in cognitive psychology, psycholinguistic reading theory, and rhetoric led to the assumptions that intellectual strategies needed in critical thinking and problem solving can be taught, that writing is one of the best ways to develop these strategies, that prereading and prewriting activities can improve reading and writing processes, and that language skills are best developed in realistic problem solving situations. As the pilot course progressed, problem solving emerged as the most important element, and giving the students short oral problems requiring a minimum of reading and writing skills was recognized as the most effective way to develop these skills. In the present version of the course, the sequencing of skill acquisition is based on the idea that problem solving is at the core and that reasoning, reading, and writing are processes needed to solve the problem. In the future, the designers of the course will seek problem solving exercises based on daily life and increased interaction with the general education faculty. (JL)

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Critical Thinking and Problem Solving

The Evolution of a Course

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I. Problem

When students arrive in our English classes each fall, we usually ask for some evidence of their reading and writing skills to give us some idea of their abilities. The result of such diagnostic exercises often reveals that a goodly number of the students do not possess the adequate skills necessary to participate effectively in the learning activities planned for the semester. These underprepared students have a number of common characteristics including a lack of practice in reading and writing and, as a result, a lack of confidence in their ability to learn. The underlying reasons for this dearth of practice and confidence, as teachers know, are numerous and complex. The reasons most often given range from poor student motivation to unreasonable teacher-student ratio prohibiting sufficient opportunities for attention to the development of communication skills.

The purpose of this paper is not to fix the blame or analyze the causes. It is rather a description of an attempt to fix the situation, that is, to offer one possible approach that could help solve the problem of underdeveloped minds in the first year of college.

In our specific case we found that about twenty percent of students enrolling in Freshman Composition fell into the underprepared category. Year in and year out, SAT scores, reading assessments, and diagnostic writing samples consistently

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revealed a high correlation with this twenty percent figure. Certainly this number, 150-200 students in our freshman class, includes a few students with learning disabilities but the vast majority of the twenty percent are not slow learners but rather what Mina Shaughnessy describes as beginning or basic writers - those students who have had little previous practice in writing. These basic writers, Shaughnessy states, write the way they do not because they are "slow or non-verbal, indifferent to or incapable of academic excellence, but because they are beginners and must, like all beginners, learn by making mistakes."[1] Our experience indicates underprepared students are likewise beginners when it comes not only to writing but also to reading and logical thinking skills.

For the last several years in an attempt to service these underprepared students, we have offered a developmental English Composition course organized into seven - week modules. These classes make available an "In Progress" grade to students who need longer than the fourteen week semester to acquire the writing skills necessary to produce average or above average performance in the course requirements.[2]

Even though the faculty, administration, and students as a whole have been quite satisfied with this attempt to accommodate the underprepared student, a number of questions have nagged at us each year. One of these questions is: If we can identify the twenty percent as underprepared students from the beginning, what can we do more effectively in English 101 to develop reasoning and communication skills necessary for effective participation in general education classes, not just freshman composition? A second question follows: Is freshman composition with its traditional emphasis on writing the best course in which to develop college level skills of critical thinking, problem solving, and their application to reading as well as writing?

These questions are made more relevant as each semester we are reminded that many of the underprepared writers are neither effective or efficient readers.

Some of the teachers in the developmental courses, when faced with students having weaknesses in both writing and reading, opt to concentrate on the writing skills. The results are inevitable: reading is neglected and writing fails to receive the essential support provided by highly complementary reading skills. But, given the time constraints of a semester, the problem of teaching both college level reading and writing skills is a real one. Which skills should receive the most attention in a course intended to improve writing skills and labeled freshman composition?

II. Theory and Design

A grant from the Fund for Improvement in Post Secondary Education for 1981 along with strong support from the college administration made possible the further study of this problem concerning underprepared students in the freshman year of college. We reformulated our questions from what could we do in the freshman composition course to what ideal course could we design that would best prepare these students to participate effectively in their subsequent general education courses. These courses would include psychology, biology, history, art, sociology, and literature as well as freshman composition.

Our previous studies in rhetoric and reading together with an ERIC search of related material resulted in our postulating two basic assumptions. One of these is concerned with the student and one is directly related to the teacher:

1. That an improvement in thinking and reasoning skills[3] leads to more effective readers and writers.
2. That attention to the process of reading and writing leads to more beneficial teacher intervention and thus results in more effective performance in final products.

While these assumptions are not new or radical, the two principles give some insight into this formative stage of the evolution of the course.

Continuing to draw on current research and theory, we formulated objectives and began to construct related learning activities. A few examples drawn from our readings in cognitive psychology, psycholinguistic reading theory, and rhetorical research will illustrate the contribution of such sources to the construction of course objectives and learning activities. A resource bibliography at the end of this paper contains the readings that provided the essential underpinnings for the course.

In cognitive psychology we found especially stimulating such insights as provided by Vygotsky and Bruner. For example, Vygotsky observed that it is a crucial moment in a person's intellectual development when language, both spoken and written, merge with practical activities.[4] From our own daily problem solving experience we knew what a truism this is. To read without thinking or to think without writing is to deprive ourselves of the completeness of exploration and the "coming to know" that only active integration of these skills can achieve. Especially significant we found in this respect is the role of writing. Writing, as one linguist has said, is the greatest tool invented by man to improve thinking.

Bruner, like Vygotsky, provided insight into perception and cognition and contributed much to the early formulation of our course. If discovery of solutions is to be maximized, Bruner advocates the activating of categories and competencies

before confronting the problem. Discovery, he concludes, favors the well prepared mind.[5]

In the studies in psycholinguistic theory, we found that the work done by Frank Smith, and Ken and Yetta Goodman equally beneficial in the development of the course. For example, Ken Goodman's principle that what the reader brings to the page is as importart as what the page brings to the reader provided the tie-in with the cognitive psychology studies.[6] This connection resulted in the formulation of a dominant guiding force in the creating of the learning activities: How can we prepare our minds to effectively engage the problem? That is, how can we best activate our competencies before, during, and after the thinking, reading, and writing processes required in problem solving?

We had often observed what happens when the mind is not adequately prepared. Harold Herber sums it up succinctly in describing the two types of readers: "A student who looks for ideas as he reads will find them; but if he looks for nothing he finds that too!"[7] We believe that if our minds have begun to process the subject matter intellectually before confronting a problem, we have a much better chance to increase discovery of new connections and new insights as we engage in the solving of problems.

In the field of rhetoric and composition, Odell's and Flower's studies as well as our own research gave us some degree of confidence that our approach was on a solid psychological and rhetorical foundation. Odell's research concluded that there are certain intellectual strategies both cognitive and affective underlying all rational thinking and writing. These strategies (e.g. change, logical sequence, contrast, physical context) can be defined, taught, and, if used in composing, result in writing that is more mature, more carefully thought out, and

more persuasive.[8] From the work of Flower we designed our model of the composing process as diagrammed below.[9] As the result of a research seminar on protocol analysis with Linda Flower and John Hayes combined with suggestions found in the text of Whimbey and Lochhead, we incorporated protocols, the oral verbalizing of problem-solving, as a daily learning activity. This approach is described in detail in a subsequent paper.[10]

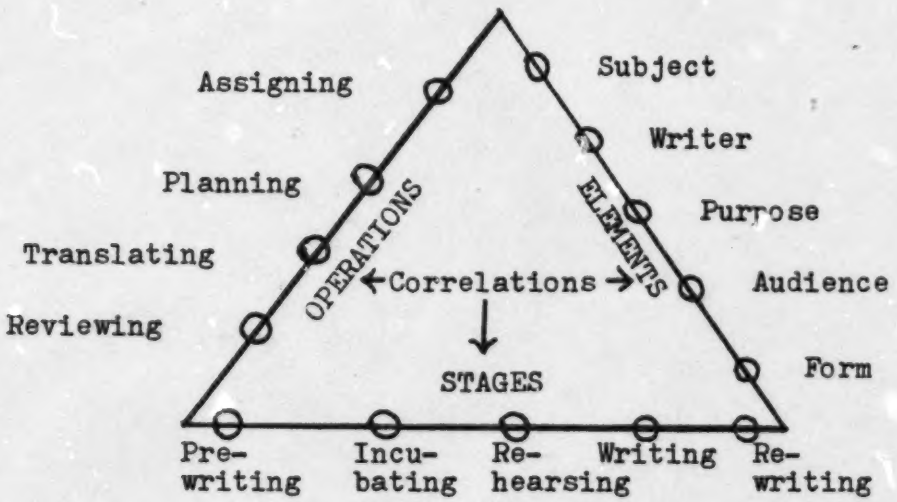

Figure 1
A Pedagogical Model of the Composing Process

From such research as outlined above, we refined our two earlier basic assumptions resulting in four guiding principles:

1. Certain intellectual strategies needed in critical thinking and problem solving can be defined and taught.

2. Writing is one of the best methods to develop long term use of these intellectual strategies.

3. Both reading and writing processes can be improved by the use of certain prereading and prewriting activities.

4. The development of language skills is most effectively accomplished in realistic problem-solving situations.

As the pilot course progressed, we realized that the fourth guiding principle concerned with problem solving was becoming the major force in shaping of the philosophy and related learning activities of the course. We started to see the course taking a different avenue to the goal of developing critical thinking and problem-solving skills. We were finding that by concentrating on oral problem-solving activities, we could develop reasoning skills (intellectual strategies and techniques) effectively and efficiently, that is, much more effectively and efficiently than when we tried to teach these reasoning skills at the same time we and the students were confronting skills and problems inherent in writing and reading processes. We concluded that a key to this acquisition of skills was the isolating of thinking skills to relatively short oral problems requiring a minimum of related reading and writing skills. Also by taping and analyzing these oral problem-solving sessions (protocol analysis) we found that both instructors and students could discover where to more beneficially intervene in the critical thinking and problem-solving processes.

III. Model

These insights and subsequent reshaping of learning activities resulted in lessening the conceptual and skill overload that so often short circuits the performance of learners when they are faced with tasks requiring an early demand of the use and integration of all three skills simultaneously. We also found that the decision to focus on oral problem solving throughout the course reduced

the pressure on teacher and student alike to produce a predetermined number of written products. We felt that subsequent courses, especially freshman composition, could provide more productive opportunities to acquire and practice these writing skills.

The course that evolved from the research and pilot course can be represented by the following diagram where problem solving is at the core and reasoning, reading, and writing are processes needed to solve the problem. We started by formulating a number of problems common to students at the freshman level in college. Then we determined which one of the three activities (reasoning, reading, writing) was dominant and what set of skills was needed to solve the problem. We wanted, as discussed above, to isolate each of the three activities in order to develop specific skills before confronting problems demanding integration of all three processes.

Our sequencing of skill acquisition is seen on the diagram where we work with 1) reasoning skills and problem solving, 2) reasoning, reading, and problem solving, 3) reasoning, writing, and problem solving, and finally 4) the integration of reasoning, reading, writing, and problem solving. This latter activity comes in the form of the self-selected and self-designed project as illustrated in 4a and 4b on the chart on page 9.

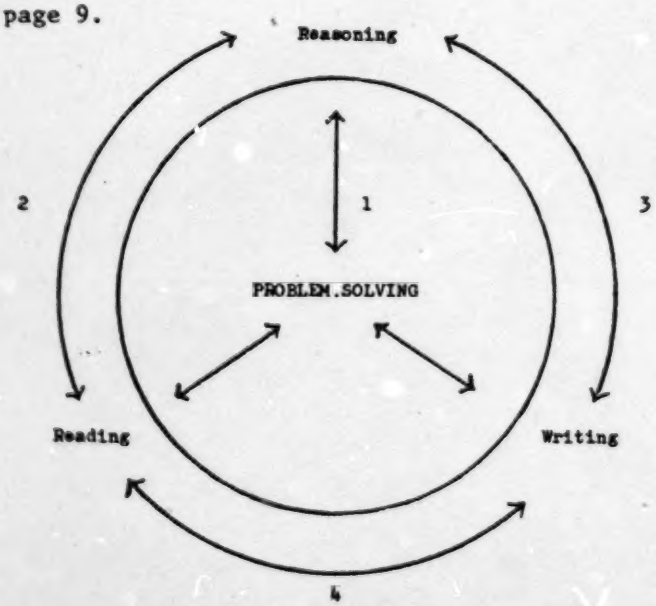

Figure 2
Sequencing of Problem-Solving Activities

The following chart contains examples of the sequencing of the activities and skills related to specific problems. The numbers correspond to the order of skills illustrated on the model diagram.

	Problem	Activity	Skills and Subskills
1a.	Choosing a career	Reasoning	Delaying closure, avoiding "satisficing" by using divergent thinking
1b.	Defining a strike or dialect	Reasoning	Matching strategies to problem: Using vertical or lateral thinking; using temporal, causal, contrastive sequencing
2a.	Analyzing and evaluating author's primary reason for writing	Reading	Identifying distinctions, value judgments, and techniques of proof
2b.	Synthesizing and retaining information	Reading	Chunking information by identifying superordinate concepts
3a.	Changing reader's image of subject matter, e.g. nuclear energy	Writing	Fitting subject matter to reader by identifying and signalling old and new information and by building bridges between shared and unshared values
3b.	Contrast two colleges or two high schools	Writing	Translating writer-based prose to reader-based prose by decentering egocentric and saturated words and by observing all conventions of edited English
4a.	Exploring and convincing self or others on solution to family problem, e.g. where grandmother can best be cared for	Reasoning, reading, and writing	All of the skills above as needed in varying degrees to acquire effective balance of attention to subject, purpose, writer, reader, and form
4b.	Exploring and convincing self or others whether college is worth the financial and time investment at this time	Reasoning, reading, and writing	All of the skills above as needed in varying degrees to achieve effective balance of attention to subject, purpose, writer, reader, and form

IV. Further Study and Application

In summary, our development of an introductory course in critical thinking and problem solving originated in the problem facing administration and faculty in accommodating underprepared students. We designed a course based o our findings in cognitive psychology, psycholinguistic theory, and rhetorical research. The pilot course resulted in the decision to place problem solving at the core and to address the essential skills of reasoning, reading, and writing separately before requiring a culminating integrative activity.

Our work in the future includes increased attention to the needs and expectations of general education faculty as well as the enrichment of the course to challenge the better prepared students. In the first case, all general education faculty should be made familiar with the concepts and skills practiced in the critical thinking course. The faculty should be encouraged to submit problems with a list of required skills for students to practice in the critical thinking course. This exchange of information should result in the continuous development of skills in the courses following critical thinking.

In turn, faculty in the general education courses should have realistic expectations concerning the goals of critical thinking. For example, many mechanical writing problems associated with underprepared students will not be eliminated. We can say, however, with some confidence, that while students will not necessarily make fewer errors, they will make a different type of error. The resulting errors will be more interesting and more tolerable. The errors are often grounded in and related to the student's attempt to explore and communicate the more sophisticated material found in the problem solving. Eliminating the earlier type of errors still leaves a paper devoid of thought and content. In contrast,

the errors resulting from work in problem solving are more worthy of attention by both student and faculty.

The second concern emerged when we discussed the structure of the course with faculty in general. An electrical engineering professor pointed out that by adding computation to reasoning, reading, and writing on the model, a much richer dimension of problem solving could be realized. Students then could get involved in such functions as hypothesis formulation, trial solutions, testing, generalizing, and verifying. In short, students could follow more formal problems to their statistical completion.

In addition to the concerns with increased faculty cooperation and course enrichment, we will continue to collect problems from daily life as well as from other courses for use in problem-solving exercises in the classroom. We also plan to conduct on-going research based on the taping of oral problem solving by the students. The result of this protocol analysis should provide us with further insight into the characteristics of ineffective and effective problem solvers. This, in turn, should indicate how and where we as teachers can most beneficially intervene in the reasoning, reading, and writing processes of our students. The utimate goal of both teacher and students is the acquisition of critical thinking skills that will enable us, in Bruner's words, to go "beyond the information given" to discover new solutions to the problems that we all face both in and out of the classroom.

Notes

1. Mina Shaughnessy. Errors and Expectations (New York: Oxford University Press, 1977), p. 5.

2. A description of this modular approach to freshman composition now in its tenth year is available by writing to Harold E. Nugent, Coordinator of Freshman English, Keene State College, Keene, N.H. 03431.

3. Terminology concerning thinking, reasoning, and logic remains a problem. Susan Langer reminds us that while we can measure validity of thought by formal analysis, the measure of validity is not the process of thinking. "Logic is one thing and thinking is another. Thought may be logic, but logic itself is not a way of thinking." Mind: An Essay on Human Feeling (Baltimore: John Hopkins Press), pp. 148-149.

4. Lev Vygotsky. Thought and Language (Cambridge, Mass.: The M.I.T. Press).

5. Jerome Bruner. "The Act of Discovery," On Knowing: Essays for the Left Hand (Cambridge, Mass.: Harvard University Press, 1962), p. 82.

6. Kenneth Goodman. "Behind the Eye: What Happens in Reading," Reading: Process and Program (Champaign, Ill.: National Council of Teachers of English, 1974), pp. 3-38.

7. Harold Heber. Teaching Reading in the Content Areas (Englewood Cliffs, N.J.: Prentice-Hall, 1978), p. 33.

8. Lee Odell. "Measuring Changes in Intellectual Processes as One Dimension of Growth in Writing," Evaluating Writing Charles Cooper and Lee Odell, editors, (Urbana, Ill.: NCTE), p. 167.

9. Linda Flower. "Problem-Solving Strategies in the Writing Process," College English, 39 (December 1977), pp. 449-461.

10. See "Critical Thinking and Problem Solving: Protocols for the Classroom," Susan Monroe Nugent and Harold E. Nugent. A paper presented at New England Association of Teachers of English, Bedford, N.H. October 8, 1982. ERIC forthcoming.

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